TAXONOMIC AND NOMENCLATURAL STATUS OF *TROCHISCIA* KÜTZING AND *TROCHISCIA MONILIFORMIS* MONTAGNE

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ABSTRACT — *Trochiscia moniliformis* Montagne (1838) was published as a marine species of the freshwater genus *Trochiscia* Kützing (1834). Accrediting Montagne with having established a genus of diatoms bearing the name *Trochiscia* is erroneous. The genus *Podosira* Ehrenberg (1840) is based on *T. moniliformis*. The correct name of this species is *P. hormoides* (Montagne) Kützing. The current treatment of *Trochiscia* as a genus of chlorococcalean algae is supposedly based on Kützing's second use of the name (1845), but none of the four original species is identifiable. Therefore, the name should be rejected not only because it is a later homonym, but because its taxonomic application is uncertain. The name *Glochiococcus* De Toni (1888) is available for certain species originally assigned to *Acanthococcus* Lagerheim (1883) (not *Acanthococcus* Hooker f. & Harvey 1845 in the rhodophycean family Cystocloniaceae) and subsequently transferred to *Trochiscia*.

RÉSUMÉ — Lors de sa publication, *Trochiscia moniliformis* Montagne (1838), fût considéré comme une espèce marine appartenant au genre d'eau douce *Trochiscia* Kützing (1834). Il est donc erroné de considérer que Montagne a établi un genre de diatoméee portant le nom *Trochiscia*. Le genre *Podosira* Ehrenberg (1840) est basé sur *T. moniliformis*. La dénomination correcte de cette espèce est *P. hormoides* (Montagne) Kützing. Le traitement habituel de *Trochiscia* comme genre d'algue verte (Chlorococcales) est soit-disant basé sur un usage ultérieur de ce nom par Kützing (1845), avec un second sens, mais aucune des quatre espèces originales n'est identifiable. Par conséquent, le nom doit être rejeté, non seulement parce qu'il est un homonyme postérieur, mais aussi parce que son application taxinomique est incertaine. Le nom *Glochiococcus* De Toni (1888) est disponible pour certaines espèces assignées originellement à *Acanthococcus* Lagerheim (1883) (non *Acanthococcus* Hooker f. & Harvey 1845 qui est un genre d'algue rouge appartenant à la famille des Cystocloniaceae) et transférées ultérieurement dans le genre *Trochiscia*.

KEY WORDS — *Trochiscia, Podosira, Acanthococcus, Glochiococcus*, diatoms.

INTRODUCTION

Although Camille Montagne was justly famed for his mastery of all groups of cryptogams, he ventured to describe only eleven new species of diatoms and is seldom encountered in diatom literature. It was thus a pleasant surprise to see the recent review of Montagne's diatomological efforts by J. P. Kociolek, D. Lamy, and

B. de Reviers (1995). Those authors provided detailed notes and photographs of type specimens and unpublished drawings housed in the Laboratoire de Cryptogamie, Muséum National d'Histoire Naturelle, Paris (PC). On seeing that their treatment of *Trochiscia moniliformis* Montagne (1838, p. 349) embodied some misinterpretations, I sent them my comments. Dr. de Reviers kindly invited me to publish these comments, to which I now add pertinent taxonomic and nomenclatural ramifications.

TROCHISCIA MONILIFORMIS MONTAGNE

In interpreting Montagne's *Trochiscia moniliformis* as the single species in a new genus, Kociolek *et al.* (1995) were perpetuating an error that may be traced back at least as far as Van Heurck's *Treatise* (1896, p. 555), in which *Trochiscia* Montagne appears in the index as a synonym of *Podosira* Ehrenberg (1840a, p. 161). In Mills (1935, p. 1671), *Trochiscia* Montagne is also listed as a synonym of *Podosira*, with *T. moniliformis* being referred to *P. hormoides* (Montagne) Kützing (1844, p. 52), based on *Melosira hormoides* Montagne (1839, p. 2). Van Landingham (1978, p. 4116), who also listed *Trochiscia* Montagne as a synonym of *Podosira*, confused the issue by adding as a second species *T. antarctica* Fritsch (1912, pp. 316, 325, pl. 10: fig. 30), which he annotated «(Not a diatom)». Finally, Robert Ross submitted an entry for *Trochiscia* Montagne to the *Index Nominum Genericorum (Plantarum)*, which was published in 1979 (Farr *et al.*, 1979, p. 1806).

The correct nomenclatural interpretation begins with the realization that Montagne, in describing *Trochiscia moniliformis* as an epiphyte of seaweeds in Peru, was adding a marine species to *Trochiscia* Kützing (1834, p. 64), a genus which until then included only freshwater species. Although Montagne did not cite Kützing, he did not claim that he was proposing a new genus, as he did elsewhere in the same paper ("*Acropeltis* Montag. mss. nov. gen.", p. 355). Moreover, his description of *T. moniliformis* agrees with the description of *Trochiscia* given by Kützing. Thus, the rationale for attributing a new genus to Montagne must rest on the fact that *T. moniliformis* turned out to be a diatom rather than a member of Kützing's poorly defined genus of «*Desmidiaceae liberae*».

After realizing that *T. moniliformis* was a diatom, Montagne (1839, p. 2) transferred it to *Meloseira* C. Agardh (1824, pp. XIV, 8), a genus whose name was subsequently conserved with the spelling *Melosira*. Without explanation, Montagne changed the epithet from *moniliformis* to *hormoides*, undoubtedly because of the prior existence of *Melosira moniliformis* C. Agardh (1824, p. 8). The latter species is usually cited *M. moniliformis* (O.F. Müller) C. Agardh, but *Conferva moniliformis* O.F. Müller (1783, p. 83, pl. III: figs. 1-5), the intended basionym, is a later homonym of *C. moniliformis* Withering (1776, p. 750) and is thus illegitimate and proscribed from serving as a basionym by Art. 45.4 of the International Code of Botanical Nomenclature (Greuter *et al.*, 1994). *Melosira moniliformis* must thus be treated as a *nomen novum* in accordance with Art. 58.3 of the ICBN. The change in date of *Melosira moniliformis* from 1783 to 1824 renders this name superfluous and hence illegitimate since C. Agardh cited as a synonym *Conferva inflexa* Roth (1797, p. 203, pl. V: fig. 5), which he was obligated to adopt as the epithet-bringing name.

The genus *Podosira* Ehrenberg (1840a, p. 161) was unequivocally based on *Trochiscia moniliformis* Montagne. However, in accordance with Art. 58.3 of the

ICBN, the intended combination *Podosira moniliformis* must be considered a *nomen novum* attributable directly to Ehrenberg because of the prior existence of *Trochiscia moniliformis* (Turpin) Meneghini (1837, p. 16), based on *Tessarthonia moniliformis* Turpin (1828, p. 316, pl. 13: fig. 18). Moreover, Ehrenberg was obligated to adopt the epithet *hormoides*, which Montagne (1839, p. 2) had previously proposed as a substitute for *Trochiscia moniliformis* Montagne. Kützing (1844, p. 52) rectified the situation by making the combination *Podosira hormoides* (Montagne) Kützing. Meanwhile, however, Ehrenberg had published another superfluous and hence illegitimate name for Montagne's species, *P. nummuloides* Ehrenberg (1840b, p. 158). While Ehrenberg later reverted to using *P. moniliformis*, this name and *P. nummuloides* refer to one and the same species rather than to two different species as implied by Kociolek *et al.*

In summary, the generic name *Trochiscia* Montagne and the combination *Podosira moniliformis* (Montagne) Kützing (cited by Kociolek *et al.*) are fictitious. The correct name of the type species of *Podosira* Ehrenberg is *P. hormoides* (Montagne) Kützing. The synonymy follows:

Podosira hormoides (Montagne) Kützing (1844, p. 52)
Trochiscia moniliformis Montagne (1838, p. 349), *nom. illeg.*
Melosira ("Meloseira") hormoides Montagne (1839, p. 2)
Podosira moniliformis Ehrenberg (1840a, p. 161), *nom. illeg.*
Podosira nummuloides Ehrenberg (1840b, p. 158), *nom. illeg.*

TROCHISCIA KÜTZING

The generic name *Trochiscia* is problematic. It was applied by Kützing to two different genera, the first in 1834, the second in 1845. The first diagnosis, «*Corpuscula vesiculosa plerumque globosa aut solitaria aut binatim aut quaternatim conjuncta*», could apply to many different algae in more than one major taxonomic group. Kützing assigned the genus to the «*Desmidiaceae liberae*», alongside true desmids (e.g., *Closterium* and *Micrasterias*), diatoms (*Biddulphia*), and Chlorococcales (*Scenedesmus*). Of the six original species, three were newly described (*T. solitaris*, *T. dimidiata*, and *T. elliptica*) while three had been described previously by Turpin (1828) in the genus *Heterocarpella* Bory de Saint-Vincent (*H. bijuga*, *H. quadrijuga*, and *H. amara*).

Kützing mentioned coloration for only three species, two of which were said to be green, and one olive-green. Neither Turpin's figures (pl. 13: figs. 13-15) nor those of Kützing (pl. XVIII: figs 74-77) are substantially helpful in deciding what those authors had in hand. After eleven years, Kützing (1845, p. 129) explicitly abandoned the genus *Trochiscia* as he had previously conceived it, but retained the name for a new genus of individual spherical or somewhat elliptical cells which were polygonal or had spines or tubercles. It is more or less in this sense that the generic name has persisted to the present time.

Beginning with *Trochiscia nivalis* Lagerheim (1892, p. 530, pl. 28: fig. 23), several species of the genus have been described from snow and ice. In her monograph on kryovegetation, Kol (1968, pp. 141-143) included *Trochiscia* Kützing (1845) in the green algal order Chlorococcales, but without assigning it to a family. She recognized six species, including *T. antarctica* Fritsch.

In their monograph of planktonic Chlorococcales, Komárek & Fott (1983, pp. 448-453) placed the genus provisionally in the subfamily Lagerheimioideae of the

family Oocystaceae. They discussed five non-kryophilic species. The continued identification of this genus with *Trochiscia* Kützing (1845) seems to be a matter of courtesy, tradition, or inertia, since neither of these most recent treatments includes any of the four original species in the genus, all of which were described as new by Kützing (*T. protococcoides*, *T. papillosa*, *T. palustris*, and *T. multangularis*). Komárek & Fott (1983) admitted that none of the four original species were identifiable and pointed out the need for a taxonomic revision of the numerous species currently assigned to the genus, some of which probably represent zygospores of desmids and other algae.

Komárek & Fott (1983) recognized with certainty only four species of *Trochiscia* — *T. aciculifera* (Lagerheim) Hansgirg, *T. hystrix* (Reinsch) Hansgirg, *T. granulata* (Reinsch) Hansgirg, and *T. americana* Kol — which they divided into two groups. Species in the first group (the first two species) were said to have spines, a thin, colorless, mucilaginous sheath, and a pyrenoid-bearing chloroplast in each cell. Species in the second group (the third and fourth species) were said to have tuberculate or reticulate cell walls without a mucilaginous sheath and one or more than one chloroplast in each cell, without pyrenoids. Reproduction by both hemizoospores and autospores is found in the first group, while only autospores are found in the second group. Komárek & Fott indicated that the generic name *Acanthococcus* Lagerheim (1883, p. 61) was available for the first group, the generic name «*Cymatococcus* Hansg. 1888» for the second group.

Trochiscia Kützing (1845) must either be conserved or rejected because it is a later homonym of *Trochiscia* Kützing (1834) and a name of uncertain taxonomic application. However, the course of action suggested by Komárek & Fott (*loc. cit.*) involves two nomenclatural problems. First, *Acanthococcus* Lagerheim is also a later homonym, being predated by *Acanthococcus* J.D. Hooker & Harvey (1845, p. 261), which applies to a currently recognized genus in the rhodophycean family Cystocloniaceae. The homonymy was addressed by De Toni (*in* De Toni & Levi, 1888, p. 457), who proposed the substitute name *Glochiococcus* for the later homonym. De Toni (or De Toni & Levi) proposed combinations in this generic name for seven species previously assigned to *Acanthococcus* while De Toni proposed a superfluous new name for *A. aciculiferus* Lagerheim, one of the two original species of that genus.

Considering that *Trochiscia* is a poor candidate for conservation because of its indefinite taxonomic application, it seems reasonable to apply *Glochiococcus* De Toni to the two species referred to *Acanthococcus* by Komárek & Fott (*loc. cit.*). These two species thus may be called ***Glochiococcus aciculiferus*** (Lagerheim) P.C. Silva, comb. nov. (*Acanthococcus aciculiferus* Lagerheim, 1883, p. 62, pl. I: fig. 21; type locality: Sundbyberg near Stockholm, Sweden) (*Glochiococcus flahaultianus* De Toni *in* De Toni & Levi, 1888, p. 458, *nom. illeg.*) and *G. hystrix* (Reinsch) De Toni (*in* De Toni & Levi, 1888, p. 458) (*Acanthococcus hystrix* Reinsch, 1886, p. 241, pl. XII: fig. 25; type locality: South Georgia). The other six existing combinations in *Glochiococcus* are the following:

G. anglicus (A.W. Bennett) De Toni & Levi, 1888, p. 457. *Acanthococcus anglicus* A.W. Bennett, 1888, p. 2, pl. I: fig. 4. *Trochiscia anglica* (A.W. Bennett) Hansgirg, 1888b, p. 128.

G. granulatus (Reinsch) De Toni *in* De Toni & Levi, 1888, p. 458. *Acanthococcus granulatus* Reinsch, 1886, p. 239, pl. XI: figs. 3, 4. *Trochiscia granulata* (Reinsch) Hansgirg, 1888b, p. 128.

G. hirtus (Reinsch) De Toni *in* De Toni & Levi, 1888, p. 458. *Palmella hirta* Reinsch, 1866, pl. XXIV:D:III. *Acanthococcus hirtus* (Reinsch) Lagerheim, 1883, p. 61.

G. insignis (Reinsch) De Toni *in* De Toni & Levi, 1888, p. 458. *Acanthococcus insignis* Reinsch, 1886, p. 243, pl. XII: fig. 22a-c. *Trochiscia insignis* (Reinsch) Hansgirg, 1888b, p. 129.

G. minor (Hansgirg) De Toni & Levi, 1888, p. 458. *Acanthococcus minor* Hansgirg, 1885, p. 395. *Trochiscia minor* (Reinsch) Hansgirg, 1888b, p. 129.

G. palustris (Hansgirg) De Toni & Levi, 1888, p. 458. *Acanthococcus palustris* Hansgirg, 1888a, p. 274. *Trochiscia stagnalis* Hansgirg, 1889, p. 135 (priority for *T. palustris* Kützing, 1845, p. 129).

Acanthococcus Lagerheim (1883, p. 61) originally comprised two species, *Palmella hirta* Reinsch (1866) and *A. aciculiferus* Lagerheim (1883). The latter was said by Komárek & Fott (1983, p. 452) to be the best defined species in the genus and also the "Leitart" (*i.e.*, type) of its generic name. Because *Glochiococcus* is a substitute name for *Acanthococcus* Lagerheim, its type is the type of *Acanthococcus aciculiferus* (Lagerheim, 1883: pl. I: fig. 21).

The second problem with the treatment of *Trochiscia* suggested by Komárek & Fott (1983) is that there is no such thing as «*Cymatococcus* Hansg. 1888». Hansgirg (1888b, p. 129) described *Kymatococcus* as a section of *Trochiscia* to which he assigned *T. arguta* (Reinsch) Hansgirg (*Acanthococcus argutus* Reinsch, 1886, p. 242, pl. XII: figs. 19, 23), *T. insignis* (Reinsch) Hansgirg, *T. obtusa* (Reinsch) Hansgirg (*Acanthococcus obtusus* Reinsch, 1886, p. 243, pl. XII: fig. 21a,b), and *T. plicata* (Reinsch) Hansgirg (*Acanthococcus plicatus* Reinsch, 1886, p. 242, pl. XII: fig. 20). Printz (1927, p. 124) listed «*Cymatococcus* Hansgirg» as a synonym of *Trochiscia*, and he was followed in this error by Komárek & Fott (*loc. cit.*). Because neither of the two species referred to «*Cymatococcus*» by Komárek & Fott (*loc. cit.*) was included in *Trochiscia* sect. *Kymatococcus* by Hansgirg, elevation of this section to generic rank should await a monographic revision of these poorly known green unicells.

REFERENCES

AGARDH C.A., 1824 — *Systema algarum*. Lundae [Lund], XXXVIII + 312 pp.

BENNETT A.W., 1888 — Fresh-water algae (including chlorophyllous Protophyta) of the English Lake District. II. With descriptions of a new genus and five new species. *Journal of the Royal Microscopical Society [London]* 1888: 1-6, pl. I [= 16 figs.].

DE TONI G.B. & LEVI-MORENOS D., 1888 — Algae novae. *Notarisia* 3: 453-475.

EHRENBERG C.G., 1840a — [Über das Auffinden des zum schwarzen Dysodil vom Geistinger Walde gehörigen Polirschiefers und über die Natur beider als Infusorien-Schiefer.] *Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königlich Preussischen Akademie der Wissenschaften zu Berlin* 1840: 160-162.

EHRENBERG C.G., 1840b — Über noch jetzt zahlreich lebende Thierarten der Kreidebildung und den Organismus der Polythalamien. *Abhandlungen der Königlichen Akademie der Wissenschaften in Berlin, Physikalische Klasse*, 1839: 81-174, pls. I-IV.

FARR E.R., LEUSSINK J.A. & STAFLEU F.A. (eds.), 1979 — *Index Nominum Genericorum (Plantarum)*. Vol. III. *Pegaeophyton — Zyzygium*. Utrecht: Bohn, Scheltema & Holkema, pp. 1277-1896. [*Regnum Vegetabile* 102.]

FRITSCH F.E., 1912 — Freshwater algae collected in the South Orkneys by Mr. R.N. Rudmose Brown, B.Sc., of the Scottish National Antarctic Expedition, 1902-04. *Journal of the Linnean Society [London], Botany*, 40: 293-338, 1 fig., pls. 10, 11.

GREUTER W. *et al.* (eds.), 1994 — *International Code of Botanical Nomenclature (Tokyo Code). Adopted by the Fifteenth International Botanical Congress, Yokohama, August-September 1993.* Königstein: Koeltz, xviii + 389 pp. [*Regnum Vegetabile* 131.]

HANSGIRG A., 1885 — Ueber den Polymorphismus der Algen. *Botanisches Centralblatt* 22: 246-251, 277-285, 343-352, 373-383, 385-406, pls. II, III.

HANSGIRG A., 1888a — Prodromus der Algenflora von Böhmen. Erster Theil enthaltend die Rhodophyceen, Phaeophyceen und Chlorophyceen. II. Heft. *Archiv für die naturwissenschaftliche Landesdurchforschung von Böhmen* 6 (5): 1-9 + 97-288 [-290] pp., figs. 46-124.

HANSGIRG A., 1888b — Ueber die Süsswasseralgen-Gattungen *Trochiscia* Ktz. (*Acanthococcus* Lagrh., *Glochiococcus* De-Toni) und *Tetraëdron* Ktz.. (*Astericium* Corda, *Polyedrium* Näg., *Cerasterias* Reinsch). *Hedwigia* 27: 126 — 132.

HANSGIRG A., 1889 — Resultate der vom Verfasser im J. 1888 ausgeführten Durchforschung der Süsswasseralgen und der saprophytischen Bacterien Böhmens. *Sitzungsberichte der königlichen böhmischen Gesellschaft der Wissenschaften [Prag], mathematisch-naturwissenschaftliche Classe,* 1889 (1): 121-164.

HOOKER J.D. & HARVEY W.H., 1845 — Algae antarcticae... *London Journal of Botany* 4: 249 — 276, 293-298.

KOCIOLEK J.P., LAMY D. & de REVIERS B., 1995 — Taxonomic notes and typification of the diatoms described by C. Montagne. *Cryptogamie, Algologie* 16: 263-294, 29 figs.

KOL E., 1968 — *Kryobiologie. Biologie und Limnologie des Schnees und Eises. I. Kryovegetation. In* Elster H.-J. & Ohle W., *Die Binnengewässer...* Band XXIV. Stuttgart: Schweizerbart'sche. VIII + 216 pp., 68 figs. in text & on folders, XVI pls., 14 tables.

KOMÁREK J. & FOTT B., 1983. — *Chlorophyceae (Grünalgen). Ordnung: Chlorococcales. In* Elster H.-J. & Ohle W., *Die Binnengewässer...* Band XVI, Teil 7(1). Stuttgart: Schweizerbart'sche. X + 1044 pp., incl. 253 pls.

KÜTZING F.T., 1834 — Synopsis diatomearum oder Versuch einer systematischen Zusammenstellung der Diatomeen. *Linnaea* 8: 529-620, pls. XIII-XIX.

KÜTZING F.T., 1844 — *Die kieselschaligen Bacillarien oder Diatomeen.* Nordhausen. 152 pp., XXX pls.

KÜTZING F.T., 1845 — *Phycologia germanica...* Nordhausen, X + 340 pp.

LAGERHEIM G., 1883 — Bidrag till Sveriges algflora. *Öfversigt af Kongl. [Svenska] Vetenskaps-Akademiens Förhandlingar* 40 (2): 37-78, pl. 1 [= 35 figs.].

LAGERHEIM G., 1892 — Die Schneeflora des Pichincha. Ein Beitrag zur Kenntniss der nivalen Algen und Pilze. *Berichte der Deutschen Botanischen Gesellschaft* 10: 517-534, pl. XXVIII.

MENEGHINI G., 1837 — Conspectus algologiae Euganeae. *Comentarii di Medicina del dott. G.F. Spongia* 4: 321-355. [37 pp. as reprint.]

MILLS F.W., 1935 — *An index to the genera and species of the Diatomaceae and their synonyms.* Part 21. London: Wheldon & Wesley, pp. 1571-1726.

MONTAGNE [J.F.] C., 1838 ("1837") — Centurie de plantes cellulaires exotiques nouvelles. *Annales des Sciences naturelles, Botanique,* sér. 2, 8: 345-370.

MONTAGNE [J.F.] C., 1839 — *Florula boliviensis. Cryptogames de la Bolivia, recueillies par Alcide d'Orbigny. In* d'Orbigny A., *Voyage dans l'Amérique méridionale...* Vol. 7. part 2. Paris. 119 pp., 3 pls.

MÜLLER O.F., 1783 — Strand-Pärlebandet och Armbandet, tvänne Microscopiska Strandväxter. *Kongl. [Svenska] Vetenskaps Academiens nya Handlingar* 4: 80-85, pl. III: figs. 1-7.

PRINTZ H., 1927 — *Chlorophyceae (nebst Conjugatae, Heterocontae und Charophyta). In* Engler A. (ed.), Die natürliche Pflanzenfamilien... Ed. 2. Band 3. Leipzig: Wilhelm Engelmann. 463 pp., 366 figs.

REINSCH P.F., 1866 — De speciebus generibusque nonnullis novis ex Algarum et Fungorum classe. *Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft* 6: 111-144, pls. XX-XXV.

REINSCH P.F., 1886 — Ueber das Palmellaceen Genus *Acanthococcus*. *Berichte der Deutschen Botanischen Gesellschaft* 4: 237-244, pls. XI, XII.

ROTH A.W., 1797 — *Catalecta botanica*... Fasc. 1. Lipsiae [Leipzig]. VIII + 244 [+ 10] pp., VIII pls.

TURPIN P.J.F., 1828 — Aperçu organographique sur le nombre deux... *Mémoires du Muséum National d'Histoire Naturelle [Paris]* 16: 295-344, pl. 13.

VAN HEURCK H., 1896 - *A treatise on the Diatomaceae*... London. xx + 558 pp., 291 figs., 38 pls.

VANLANDINGHAM S.L., 1978 — *Catalogue of the fossil and recent genera and species of diatoms and their synonyms*. Part VII. *Rhoicosphenia through Zygoceros*. Vaduz: J. Cramer, pp. 3606-4241.

WITHERING W., 1776 *A botanical arrangement of all the vegetables naturally growing in Great Britain*. Birmingham, xcvi + 838 pp., XII pls.